More Honey and More Gentle Bees

THAT is what everybody wants to know! HOW does a beekeeper produce more honey, and how to work his bees with fewer stings! You expect me, or famous Roger Morse, or Mark Winston, or your local bee group, or the Internet Bee-L just to say a short speech or write a few notes and THEN you will know. You must be kidding, because IT AIN'T GOING TO HAPPEN!

A surgeon just doesn't learn how to cut with a scalpel; but, he has to learn all about pharmaceutical drugs so that he prescribe them. An astronaut is not just an accomplished jet-pilot; but, he as to study astronomy and trigonometry. Your auto mechanic today must understand fuel injection as well as carburetion and know that 12 mm wrench won't turn a 1/2" nut.

If you really want to be a beeKEEPER rather than just a beeHAVER, so that you can truly produce more honey than others, work your bees dressed in shorts and a tee shirt, or not have your bees die of diseases or pests, you will have to LEARN more than putting some supers in place in the spring and removing them in late summer.

If this article was titled: BEE BEHAVIOR, many of you would have laid it aside for future reading or even thrown it in the trash. If you were a beeHAVER last year, you will still be a beeHAVER next year; and you will never find the true JOYS OF BEEKEEPING until you understand bee behavior! More important, perhaps, will be MY feeling that "I have failed to upgrade you" from the foolishness of just "having" bees, buying more bees when the die, wearing a hot suit and gloves, losing swarms, not making at least 100 pounds of honey per colony each year, and unable to publicly demonstrate your knowledge of bees by performing an open hive inspection to prove to the neighbors that honey bees are not naturally aggressive.

Let me stop this embarrassing rhetoric, and give you an initial understanding of:

Bee Behavior

Honey bees don't think like humans, nor do they understand ANGER, KINDNESS, GIFTS, STEALING, CHEATING, INDIVIDUALITY, LOAFING, RETIREMENT or DEATH. Hence, one of the major mistakes made by bee novices is being anthropomorphic, i. e., ascribing human characteristics to nonhuman things. Bees think like bees, not like humans! You have to learn to think like a bee, because a bee can never learn to think like a human. Honey bees do have brains, but their knowledge was "put there when they were CREATED", and they have minimal learning ability in their short six weeks of life. From the very instant that they emerge from their wax cell, they know WHAT to do, WHEN to do it, and HOW to do it! They do NOT have to be taught, shown, or supervised! In contrast, I hope that I can tell you WHAT you can do and not do, WHEN to do it and not to, and HOW to do it as well as HOW NOT to do it.

A paramount difference between how we humans think about the prime purpose of our lives as compared to how a honey bee feels about life is about as different as salt and pepper. Although humans have many purposes for living, some more important than others, they are far distant from the single purpose of living of a bee. That single purpose of a worker bee's life is to provide for the continuation and expansion of the COLONY! COLONY! COLONY! Think about these examples: A worker bee is "born" on May 1st at the start of the main nectar flow and drops dead from overwork six weeks later on June 15th. All that nectar she collected was done to provide honey to get the colony through the coming winter, but she never felt a cold day in her life, and hence has no idea of what "winter" is. A foraging bee upon smelling the alarm pheromone, isopentyl acetate, stops foraging, and in order to protect the colony's future, sacrifices her life by stinging the beekeeper who was disturbing the colony. A worker bee takes part in killing the old queen, her mother, who is being superseded by a new, younger, highly, virile queen so that the colony can survive and expand. The great majority of humans think only of themselves "getting ahead" rather than sacrificing their lives for their sisters or half brother, or "working themselves to death" to provide for future generations who are not their children or grandchildren.

BEE BEHAVIOR cannot be studied by OPENING a hive or using SMOKE, because both of these unnatural things disrupt normal behavior! The use of a glass Observation Hive "opened the door" to be able to delve into bee behavior; and now in our day of advanced technology, we can use RADAR and even microchip transmitters. As in so many other areas of life, often repeated speculation and theories found in the beekeeping literature gradually assumes the status of FACT, and this stifles further research. WHY investigate something that is ALREADY "KNOWN"? These assumed FACTS have usually been advanced by well thought of or well spoken beekeepers who are NOT investigative SCIENTISTS, and these assumed facts delay research for long periods of time. Like all scientists, I find it interesting that the more we know, the more we want to know!

Almost 100% of all beekeepers begin their association with apis mellifera with anthropomorphic thinking, and unfortunately only a few ever fully free themselves of this faulty analysis of the rationale of apian actions. Such thinking indicates that a bee stings because it is ANGRY; or that the ability of honey bees to build a perfect wax comb without plans or instruction indicates a bee is CLEVER; or a bee who works 24 hours each day for the benefit of the colony and dies of cardiac arrest carrying a heavy load of nectar in flight is AMBITIOUS. Nothing could be further from the truth! Bees react like biological robots to the stimuli of their environment, because their nervous system is programmed genetically to react in a prescribed manner. Bees react without thought or awareness of the mechanisms and consequences of their behavior!

Since there is no "king, president, ruler, boss, supervisor, or teacher" who dictates "who does what and when", what is it that directs the activities of the colony? We know that it is not the queen, because we know that the activities of a colony proceed normally for several days in the absence of a queen. Further, scientists have placed brood combs and a queen cell in an incubator without a single ADULT bee present, and observed the actions of the bees and queen AFTER they had emerged from their cells. Although totally deprived of contact with any experienced adult bee, these new bees behaved EXACTLY in the same manner as a normal

colony after the bees become old enough to behave in normal ways. This is difficult for humans to understand, because we are NOT programmed at birth, but have to be taught and learn as we age. One can only conclude that bees are genetically taught and demonstrate the identical behavioral manners in the year 2000 as they did in the days of Caesar and Cleopatra. Hence, again I say: Since a honey bee basically can NOT learn anything, a beekeeper can not change anything in the programmed life of a bee. Only by learning and understanding BEE BEHAVIOR or "thinking like a bee" will a person become a highly successful beekeeper! Why don't you take a "break" here, rest your eyes, get a coke, take a bite of cut comb honey to give you energy and then I will provide you with many of the details of bee behavior with which you should really be very conversant. These are just the basic behavioral factors that anyone "alluding to be a KEEPER of bees rather than HAVING bees" should know. There are many writings, notably by Gary, Seely, Winston, and others, than you can avail yourself to in order to learn more.

INTERNAL FACTORS AFFECTING BEHAVIOR: The AGE of a bee is a major control of her wax glands, flight muscles, honey stomach stretching, stinger development, and other parts or uses of them. Of PRIME IMPORTANCE is the difference between a "nurse" bee and a forager bee. After emerging from its cell through the next 18 days, this is a house bee or "nurse" bee since nursing young larvae is it's principle duty. During these 18 days, it does many different house duties beginning with cleaning and polishing cells before a queen will lay eggs in them, building comb, cleaning house including carrying away the dead, guard duty at the entrance, receiving nectar or pollen, storing them away, ripening nectar into honey, feeding and grooming the queen, and a dozen other jobs. After these 18 days of "house" duties, the bee has "earned her wings" and becomes a forager for pollen, nectar, water, and even propolis and remains a forager for the remaining 24 days of her life. I will wager that you never realized that the longest a bee ever forages is only 24 days and then it dies of overwork!

Another internal factor affecting behavior is the **GENETIC** makeup of the bee is based upon its race or the stock of the race it came from. Let me give you an example of the differences in stock that you are familiar with: Consider three HUMANS of the white Caucasian race, but of three different "stocks": English, Norwegian, and Italian and all three are bankers. The English man probably dresses in a suit with a vest, smokes a pipe, drinks sherry wine, and enjoys quietness in his club. The Norwegian banker also wears a suit, doesn't smoke at all, drinks brandy, loves the outdoors, and probably is tall, thin, blonde and has blue eyes. The Italian banker hates the indoors, conducts business on the sidewalk dressed only in a loose shirt, chain smokes cigarettes, drinks chianti wine, is bald, brown eyes, has tanned skin, and talks incessantly in a loud voice emphasizing many words with lots of arm waving and hand action. All three are of the white Caucasian race but of three different stocks. Both race of bee and the stock of that race have very specific differing characteristics such as gentleness, wintering ability, hygienic (housecleaning) behavior, disease resistance, foraging ability, population control, use of propolis, swarming propensity, and many more differences.

EXTERNAL FACTORS: Wow, there are SO MANY like odors, touch, light, magnetic fields, etc and the honey bee has thousands of specialized sensory cells to detect any of these many external factors. These cells can behave in different ways dependent on the intensity of the stimuli or its duration. Further, these cells are subject to fatigue and then the stimuli is not

answered by any action. Examples of this are the use of TOO MUCH smoke or TOO MUCH Bee-Go, because the use of TOO MUCH of either make the bees aggressive (nasty)!

TIME is a behavioral factor. It is known that certain flora yield nectar only in the morning hours, whereas other flora are barren in the morning but yield copiously in the late afternoon. By painting foraging bees, research has shown that bees having found a flora source that bares nectar at a given time of day only visit that source during those productive hours and either rest or do another task during the dearth hours. It is rather interesting that bees have been found to be quite "source true", meaning that a bee will NOT visit more than one kind of pollen or nectar source on a single trip. This implies that a bee will continue to work a single source on continuous trips even though other sources all around the initial source have started to yield.

COMMUNICATION: I am communicating with you by writing this paper. Since bees can't write, talk, or hear (they are very sensitive to vibration), their prime sense is olfactory (smell). The prime example is a flower blooms and bears nectar. The bee finds the nectar by its odor and in the process of sucking up that nectar brushes its fuzzy body about the flower and hence pollinates it to produce fruit. Upon returning home, it alerts other colony foragers of its find by distributing tastes of the nectar to numerous other foragers and than performs the famous von Frisch "dance" on the comb to indicate the distance and direction of the source from the hive. In the dark interior of the hive, the "dancing" bee plots the direction to the source by dancing up the comb on an imaginary line that portrays the angle of direction from the position of the sun (bees do this in the dark, and most humans couldn't do it at all). I have found it VERY INTERESTING that scientists have transferred forager age bees from the Southern Hemisphere to the Northern Hemisphere and found the bees to be totally confused in direction in this hemisphere. This proves that navigation by the bees during their "play flights" under the SOUTHERN sun prior to forager age does not allow a bee to "change this genetically programmed learning"! When bees fly on badly clouded days, they travel by apparently memorized local landmarks.

ACTIVITIES relative to behavior:

Comb Building: Worker bees have 4 wax glands on their lower abdomen, each able to produce 2 wax scales approximately 2mm x 2mm. These scales are mixed with the secretion of the mandibular gland while being masticated by the mandibles. (That is a high-powered way of saying "being chewed with spit".) It takes a bee about 4 minutes to remove one scale, masticate it, and affix it to the comb. Hence, it requires many bees to construct just one wax cell! This is the work of young bees, normally 12-18 days old. About 8 pounds of honey are consumed by these comb building bees to produce 1 pound of bees wax! This explains HOW VALUABLE DRAWN COMB IS TO THE BEEKEEPER!

Feeding Brood: This is a TREMENDOUS amount of work done primarily by bees aged from 3 days to 13 days old. As soon as the egg hatches into a larva, it is visited and fed over 1000 times per day, or more than 10,000 times in the 8 day period before the cell is capped. Lindauer(1953) found that 2,785 worker bees spent over 10 hours rearing just one larva in those 8 days! (I won't complain about dinner being late any more.)

Sharing Food: During the 18 days from emergence to foraging age, bees donate food to each other, at the same time continuously tapping each other with their antennae. It has be found that the odor of each bee's head is quite important. This sharing of food accompanied by touching antennae to the head area seems to be a medium of sharing pheromones (communicating).

Colony Defense: (Many readers should read this section several times so they better understand why they get stung.) Humans have difficulty understanding "colony defense", confusing "defense" with "aggression". Honey bees have many invaders, including other insects, animals, and humans, due to the ODOR of honey around a colony. The amount of defense is directly related to the intensity (or lack of) of a nectar flow. There are very few guard bees "on duty" during a strong nectar flow, and even foragers from other colonies that are loaded with either pollen or nectar can enter without being "examined" or "attacked". However, some abnormal disturbance by humans, animals, insects, or "robber honey bees" alerts the guard bees to perform detailed "examination" of all entering "critters" and their colony will be DEFENDED by driving away the interloper or stinging them. You would defend your home the same way, and this is not AGGRESSION! It is interesting to note that young bees submit easily to examination, but the "old foragers" are reluctant to be "examined". Bees do NOT get "angry" or "seek revenge" because of human disturbance of colonies; but simply react instinctively in a predictable behavioral pattern! Unlike Africanized bees, all of this defensive behavior occurs in the immediate vicinity of the colony, and the European bee does NOT chase the intruder very far away. Bees that are foraging or searching when they are away from the colony are NOT sting threats to humans unless there is some collision or entrapment. Further, even when subjected to careless manipulation by a beekeeper, it generally is only the GUARD bees that are stimulated to defend the colony. However, the other bees can be easily aroused to a defensive position if the human intruder uses POOR management techniques such as: wearing dark colors, emitting strange odors like body lotion, perfume, hair tonic, using "fuzzy" clothing like a wool sweater or having loose long hair that can entrap a bee, and PARTICULARLY moving their hands TOO RAPIDLY or using tools that shine so the bee's poor eyesight can easily see that movement. Lastly, and perhaps most important, a sting deposited in your skin or your clothes causes the immediate release of ALARM PHEROMONES that trigger other bees to help defend the colony. The stinger should be removed as quick as possible and the alarm pheromone odor emanating from the sting site should be "hidden" by abundant use of smoke on the sting site.

To open a colony without being stung, blow dense, cool, white smoke into all colony entrances, and then..... DO NOTHING FOR AT LEAST ONE MINUTE, TWO IS BETTER and then proceed. (Waiting is VERY DIFFICULT for many beekeepers)

Since STINGING is the greatest deterrent of beekeeping as well as the fear of your neighbors and the public, you should be much aware of those circumstances that quickly trigger a defensive response of a colony. Some of these things are:

1) High colony population
2) Colony manipulations at the WRONG TIME OF DAY: too early in the morning or too late in the afternoon, and never at night.
3) POOR QUALITY of smoke. Should be dense, white, and cool!

4) REDUCED flight activity at the entrance, which normally indicates poor foraging conditions, or approaching inclement weather.
5) Bees crushed by careless equipment handling, including your GLOVES.
6) Colonies frequently bothered by pests: dogs, skunks,ants, or unskilled HUMANS
7) Quick movements, dark or fuzzy clothes, shiny rings or watches, or long hair
8) Failure to remove or hide the alarm odor from a sting

Robbing Behavior: Many beekeepers simply don't understand this, even though a fine colony of bees can be totally killed in just a few hours in a bad robbing situation. From the moment of their creation, bees are genetically trained to seek out and gather all nectar or honey to provide their colony with abundant winter stores, not for themselves, but for expansion and increase of honey bees throughout the area. Most robbing occurs during dearth conditions. Some races or stocks of bees are more prone to robbing than other races. It is a well known fact that the Italian race has earned the number one title of this offense in spite of their other good points. If a beekeeper opens a colony, lays frames or supers out UNPROTECTED, keeps the colony OPEN TOO LONG, or drips honey on the GROUND, bees from other colonies detect the odor of honey coming from this "disturbed" colony, dashs back to their colony and alerts colony members to "run over and get some 'free' goodies". Why did I use the word "disturbed" colony? The beekeeper has demoralized the colony with smoke, manhandled the colony "furniture" of frames and bodies, divided the normal position of bee's living space, and opened the door to "thieves". Imagine what might happen if a small new split of only 3-4 pounds of bees being fed a big gallon of sugar syrup had a big wide front entrance, and was next door to a strong honey production colony of 12-15 pounds of bees and the nectar flow suddenly dried up! Robbing is almost always the BEEKEEPER'S FAULT! It has been shown that feral colonies are almost NEVER robbed unless their bee population is depleted by disease or death of the queen.

Fanning: Your house environment is controlled by air conditioning, humidifier, and kitchen exhaust fan. The honey bee does likewise by fanning. Fanning controls the hive temperature and humidity, evaporates water from nectar, removes exhaled bee breath, and distributes PHEROMONES throughout the colony which is important for communicating vital information QUICKLY to all colony members present in the hive.

Scent Fanning: Some the bees elevate their abdomen, opening their Nassanoff Gland, which exposes a membrane moist with a secretion whose odor is highly attractive to other bees and says "Come here to me". The "scenting" bee FANS this aroma about with her wings which directs "lost" colony members home. "Scenting" bees are very valuable when hiving a new swarm, and particularly important to direct the queen to her new home.

Hygienic Bees: We are going to hear more and more about the benefits of hygienic bees in the coming 21st century. Dr. Marla Spivak of University of Minnesota is very active in this work, and Pat Heitkam features "hygienic" bees in his advertisements for the sale of bees. About 40 years ago, both Steve Taber and Walter Rothenbuhler showed that some bees are better housekeepers than others. They observed that some bees remove dead brood from a colony faster than some other stocks of bees. Now we know that efficient housekeeping behavior contributes greatly to the RESISTANCE of bees to various diseases. Many scientists and

beekeepers feel very strongly that using bees that are disease resistant is the ultimate answer to many of our disease problems and that their use will eliminate the need for chemical treatments.

Making Honey: Nectar is the sweet liquid secreted by the flower to attract a bee to it who will POLLINATE the flower in the act of sucking up the nectar. A bee can carry as much as 70 milligrams of nectar in her honey stomach, which is almost equal to her body weight of about 82 milligrams! Most humans can't lift this figure of 85% of body weight much less fly away with it! Although there are great variations, the AVERAGE load has been shown to be 25 - 40 milligrams. Hurrying back to the hive, this heavily loaded bee injects the enzyme invertase into the nectar to convert the complex double sugar, sucrose, into two simple sugars, glucose and fructose and enters the colony. If she has found a "new" location for nectar, she "passes out samples for other to taste", and then gives flight directions to it by performing the von Frisch Dance on the comb. Then, she transfers the load of nectar to several "house" bees who widely distribute it among many cells to make water evaporation from the thin nectar easier and faster by fanning. The house bee may also added more invertase into the nectar if needed and water evaporation is continued until its content is less than 19% where upon this new HONEY is sealed in its cell with a wax capping. Since perhaps 60 pounds of nectar only yields about 15 pounds of honey, it does not take a rocket scientist to understand why EXCESS super space should always be present to provide storage space for this thin UNPROCESSED YET-TO-BE honey. Further, many scientists, particularly Rinderer, have shown that the presence of large amounts of empty COMB, not foundation, stimulates greater foraging activity for more nectar.

Need for Water: The most important need for water is to THIN honey to make food to feed larvae! At the high brood rearing time in spring, it is estimated that the average hive uses about 150 grams of water each day; and since a bee normally carries 25 milligrams per trip, 150 grams will require about 6000 foraging trips for water EACH DAY. Water is sometimes necessary to COOL the hive on a hot day, so the bees forage for water, distribute small droplets of it around the hive interior and then FAN. Honey bees invented air conditioning - not man! To cool a strong colony on a dry hot day might require a kilogram (2.2 pounds) of water, or about 40,000 foraging trips per day!

IMPORTANT NOTE: Brood rearing in Maryland starts in January or early February. You MUST have some water source near your bees THEN even in this cold weather, because once they have found a source of water, it is almost impossible to switch them to some other source anytime the rest of the year! Pay attention to this unless you don't care about your neighbor's swimming pool! You do not have to provide distilled water or bottled water. In nature, bees prefer barnyard puddles or farm lane ditches because of the vitamins and minerals in the water. Further, you don't want running water or a pan of water where the bees might drown; but you need a very damp surface or a faucet that has a very tiny leak dripping on some sand mixed with pebbles and small stones for the bees to light on without getting wet feet

Swarming Behavior: We all know that swarming is the honey bee's natural mechanism for reproduction. Swarming either expands the boundaries of that particular colony by making two colonies out of one, or replaces a colony previously lost by natural causes; but how much do you know about the behavior of the bees at swarm time? Swarm season is that 4-6 week occurring shortly after both pollen and nectar sources have become abundantly available. In central

Maryland, our swarm season is generally between April 15th and May 31st. Whether or not the bees actually swarm primarily depends on the managerial ability of the beekeeper! Frankly, I consider swarms UNUSUAL in my apiary. In January and particularly February, in anticipation of spring arrival and the need of lots of bees for colony expansion by swarming, the workers overfeed the queen making her intensify her egg laying, and this will result in a highly congested brood chamber. Eggs are laid in every nook and cranny, including the queen cups that are built near the frame bottoms, usually 6 to 12 or even 20. As soon as eggs are laid in these queen cups, 3 things are going to happen within the next 10-15 days: 1) the queen cups are lavishly filled with royal jelly. 2) feeding the queen is slowed considerably and finally curtailed, hence stopping egg laying, so the queen can lose weight in order to fly with the swarm. 3) scout bees leave the hive and search first for a close by location for the swarm bees and queen to meet and organize, stay just a few hours while the scouts continue their search for a new permanent home before they take off and fly to it. Since young bees don't begin foraging until they are 19 days old, the queen has been heavily laying for several weeks, and diminished egg laying the past 10-15 days resulting in less larval feeding jobs of these young bees, they are just "standing around loafing" in the hive, impeding the work of the foragers and making tremendous congestion. Just a day or so before the first virgin queen is about to emerge, if the weather is nice, with great EXCITEMENT and a "WHIRRING" sound, half or more of all the bees and the old queen leave the hive and form a swarm cluster in some nearby tree or on some post. After settling down and ascertaining that the queen is with them, scouts are sent out to find a new home; and after several hours or maybe the next day, the bees leave for their new home. This new home is BARE, just walls and roof with no comb, no pollen or honey, and no brood. The swarm bees must go into a "crash priority" of comb building for space to store some food and cells for the queen to lay worker bee eggs to replace themselves who will all be dead within no more than 6 weeks! Since the average swarm is largely composed of YOUNG bees rather than the old forager bees, wax comb is built in a hurry, the new young larvae is well fed, and by the time all this new brood emerges in this new home, all the bees that formed the swarm will either be of foraging age or dead of old age. It should be said that swarming bees (contrary to public opinion) are LESS LIKELY TO STING than any other time of their lives, because not only are they stuffed with food provisions for their new home, but they have "no HOME and no BROOD to defend"!

Behavior of Queenless Bees: Although the queen is not the boss, leader, or supervisor of a colony, she has considerable influence on the orderly processes in the colony! When a colony becomes queenless, the bees become quite agitated and commence scent fanning hoping to "direct their queen back home" in case she is lost, and most normal activities are stopped. After several hours of queenlessness, the bees start building "emergency" queen cells from EXISTING worker bee cells that already hold an egg or a larva; and the resulting queen produced may well be a "lousy" queen because the bees selected an older larva rather than an egg or very young larva so that the larva did not receive a quality feeding of royal jelly for favorable development. In those cases where there are no eggs or young larva present when the queen disappears, such as a virgin queen NOT returning from her mating flight, there is NO HOPE for colony survival; and shortly the queen pheromone that inhibits worker bees from laying eggs will be gone. Some worker bees begin laying eggs, but since they have never been mated with a drone, they cannot fertilize the eggs they lay, and hence, all these eggs can only be drones. The eggs are NOT laid in an orderly pattern but badly scattered, more than one egg in a single cell, and the egg is rarely fastened to the bottom of the cell as it would be if laid by a queen. Unfortunately, the colony

accepts these laying workers as queens which makes the colony almost impossible to requeen with a real queen! In most instances, the best thing to do is either destroy the bees or try to unite the whole colony with a strong queenrite colony. Colonies become queenless much more often than most beekeepers think, so the beekeeper should be well aware of these symptoms in order to make quick corrections.